

MS, MMS

Installation and operating instructions



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GRUNDFOS 

English (GB) Installation and operating instructions

Original installation and operating instructions

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Warning

If these instructions are not observed, it may lead to electric shock with consequent risk of serious personal injury or death.



If these safety instructions are not observed, it may result in malfunction or damage to the equipment.



Notes or instructions that make the job easier and ensure safe operation.

 **Warning**
Prior to installation, read these installation and operating instructions. Installation and operation must comply with local regulations and accepted codes of good practice.

These instructions apply to Grundfos MS and MMS submersible motors for submersible pumps. These motors must not be put into service until the machine into which they are to be incorporated has been declared in conformity with the relevant directives.

1. Symbols used in this document



Warning

If these safety instructions are not observed, it may result in personal injury.

2. Delivery and storage

2.1 Delivery

Grundfos submersible motors are supplied from factory in proper packing in which they should remain until they are to be installed.

2.2 Unpacking

Caution

Be careful not to damage the motor cable with sharp tools when unpacking the motor.

Note

The separate nameplate supplied with the motor must be fixed close to the installation site.

Do not expose the motor to unnecessary impact and shocks.

2.3 Storage and handling

Storage temperature

-20 - +70 °C.

Caution

If MMS motors are stored, the shaft must be turned by hand at least once a month. If a motor has been stored for more than one year before installation, the rotating parts of the motor must be dismantled and checked before use.

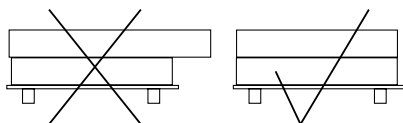
Do not expose the motor to direct sunlight.

Storage



Warning

Do not stack boxes of different lengths.



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Fig. 1 Guideline for stacking of boxes

2.3.1 Frost protection

If the motor is to be stored after use, it must be stored in a frost-free location, or the motor liquid must be frost-proof.

Caution

The motors are factory-filled with demineralised water and must therefore be stored in a frost-free location or emptied before storage.

3. General description

3.1 Applications

Grundfos MS and MMS submersible motors are designed according to market standards.

All Grundfos 4", 6" and 8" MS and MMS motors are designed to fit pump ends manufactured according to NEMA standards. The motors are ideally suited as water supply pumps for irrigation, groundwater regulation, pressure boosting, industrial water transfer and similar applications.

3.2 Pumped liquids

Clean, thin, non-flammable, non-combustible or non-explosive liquids not containing solid particles or fibres.

The maximum sand content of the pumped liquid must not exceed 50 g/m³.

The N, R and RE motor versions are designed for liquids with higher aggressiveness than drinking water.

Materials in contact with the liquid:

- **MMS:** cast iron DIN W.-Nr. 0.6025 and NBR rubber.
- **MMS -N:** stainless steel DIN W.-Nr. 1.4401 and NBR rubber.
- **MS/MMS -R:** stainless steel DIN W.-Nr. 1.4539 and NBR rubber.
- **MS -RE:** stainless steel DIN W.-Nr. 1.4539/1.4517 and FKM rubber.

The maximum liquid temperature appears from section [4.3 Liquid temperatures/cooling](#).

3.3 Sound pressure level

The sound pressure level has been measured in accordance with the rules laid down in the EC Machinery Directive 98/37/EC.

The sound pressure level of Grundfos MS and MMS motors is lower than 70 dB(A).

4. Preparation

Warning



Before starting work on the product, switch off the power supply. Make sure that the power supply cannot be accidentally switched on.

Warning



To avoid personal injury when handling the motor, use a strap or a lifting eye and a crane for lifting.

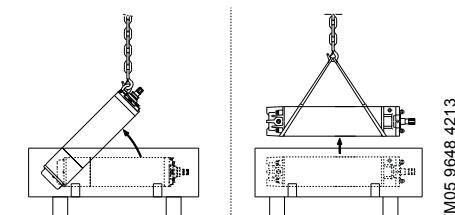


Fig. 2 Handling of the motor

4.1 Checking of liquid in motor

The submersible motors are factory-filled with a special FDA-approved, non-toxic liquid which is frost-proof down to -20 °C.

Note

The level of the liquid in the motor must be checked and the motor must be refilled, if required. Use tap water.

Caution

If frost protection is required, a special Grundfos liquid must be used to refill the motor. Otherwise, tap water may be used for refilling.

Refilling of liquid is carried out as described below.

4.1.1 Grundfos MS 402 and MS 4000 submersible motors

The filling hole for motor liquid is placed in the following positions:

MS 402: in the bottom of the motor.

MS 4000: in the top of the motor.

1. Position the submersible motor as shown in fig. 3. The filling screw must be at the highest point of the motor.
2. Remove the screw from the filling hole.
3. Inject liquid into the motor with the filling syringe (fig. 3) until the liquid runs back out of the filling hole.

4. Replace the screw in the filling hole and tighten securely before changing the position of the motor.

Torques:

MS 402: 2.0 Nm.

MS 4000: 3.0 Nm.

The submersible motor is now ready for installation.

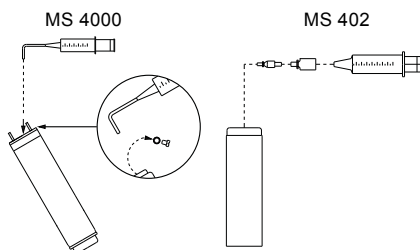


Fig. 3 Motor position during filling - MS 4000 and MS 402

4.1.2 Grundfos MS 6000 submersible motors

- If the motor is delivered from stock, the liquid level must be checked before the motor is installed. See fig. 4.
- In the case of service, the liquid level must be checked. See fig. 4.

Filling procedure:

The filling hole for motor liquid is placed at the top of the motor.

1. Position the submersible motor as shown in fig. 4. The filling screw must be at the highest point of the motor.
2. Remove the screw from the filling hole.
3. Inject liquid into the motor with the filling syringe (fig. 4) until the liquid runs back out of the filling hole.
4. Replace the screw in the filling hole and tighten securely before changing the position of the motor.

Torque: 3.0 Nm.

The submersible motor is now ready for installation.

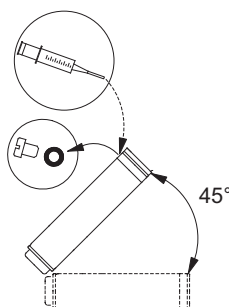


Fig. 4 Motor position during filling - MS 6000

4.1.3 Grundfos MMS6, MMS 8000, MMS 10000 and MMS 12000 submersible motors

Filling procedure:

Place the motor at a 45 ° angle with the top of the motor upwards. See fig. 5.

1. Unscrew the plug (A) and place a funnel in the hole.
2. Pour tap water into the motor until the motor liquid inside the motor starts running out at the plug (A).

Caution Do not use motor liquid that contains oil.

3. Remove the funnel and refit the plug (A).

Before fitting the motor to a pump after a long period of storage, lubricate the shaft seal by adding a few drops of water and turning the shaft.

Caution

The submersible motor is now ready for assembly with the pump and ready for installation.

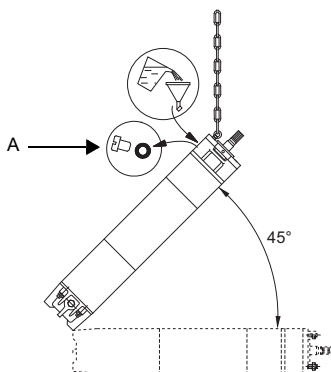


Fig. 5 Motor position during filling - MMS

4.2 Positional requirements

The motor can be installed either vertically or horizontally.

4.2.1 Motors suitable for horizontal installation

Motor type	Output power 50 Hz	Output power 60 Hz
	[kW]	[kW]
MS	All sizes	All sizes
MMS6	5.5 - 37	5.5 - 37
MMS 8000	22-92	22-92
MMS 10000	75-170	75-170
MMS 12000	147-190	-

Caution

During operation, the motor must always be completely submerged in the liquid. Please consult the pump manufacturer's NPSH data.



Warning

If the motor is used in hot liquids (40-60 °C), make sure that no one can come into contact with the motor and the installation, e.g. by installing a guard.

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4.3 Liquid temperatures/cooling

The maximum liquid temperature and the minimum flow velocity past the motor appear from the following table.

Grundfos recommends installing the motor above the well screen in order to achieve proper motor cooling via liquid passing the motor.

Note

If the stated flow velocity cannot be achieved in the borehole, a flow sleeve must be installed.

If there is a risk of sediment build-up, such as sand, around the motor, a flow sleeve should be used in order to ensure proper cooling of the motor.

Motor	Flow past the motor [m/s]	Installation	
		Vertical	Horizontal
MS 402 MS 4000 (T40) MS 6000 (T40)	0.15	40 °C (~ 105 °F)	40 °C (~ 105 °F)
MS 4000I (T60)* MS 6000 (T60)*	1.00	60 °C (~ 140 °F) Flow sleeve recommended	60 °C (~ 140 °F) Flow sleeve recommended
MS 6000 (T60)**	0.15	60 °C (~ 140 °F) Flow sleeve recommended	60 °C (~ 140 °F) Flow sleeve recommended
MMS6	PVC windings	0.15	25 °C (~ 86 °F)
		0.50	30 °C (~ 95 °F)
	PE/PA windings	0.15	45 °C (~ 113 °F)
		0.50	50 °C (~ 122 °F)
	PVC windings	0.15	25 °C (~ 77 °F)
		0.50	30 °C (~ 86 °F)
MMS 8000 to 12000	PE/PA windings	0.15	40 °C (~ 104 °F)
		0.50	45 °C (~ 113 °F)

* At an ambient pressure of minimum 1 bar (0.1 MPa).

** At an ambient pressure of minimum 2 bar (0.2 MPa).

Note

For 37 kW MMS6 (only PVC windings), 110 kW MMS 8000 and 170 kW MMS 10000, the maximum liquid temperature is 5 °C lower than the values stated in the above table. For 190 kW MMS 10000, 220-250 kW MMS 12000/50 Hz and MMS 12000/ 60 Hz, the temperature is 10 °C lower.

5. Electrical connection



Warning

Before starting work on the product, switch off the power supply. Make sure that the power supply cannot be accidentally switched on.

5.1 General

The electrical connection must be carried out by an authorised electrician in accordance with local regulations.

The supply voltage, rated maximum current and $\cos \phi$ appear from the separate nameplate that must be fitted close to the installation site.

The required voltage quality for Grundfos MS and MMS submersible motors, measured at the motor terminals, is $-10\% / +6\%$ of the nominal voltage during continuous operation (including variation in the mains voltage and losses in cables).

Furthermore, check that there is voltage symmetry in the power supply lines, i.e. same difference of voltage between the individual phases. See also section 10. *Checking of motor and cable*, item 2.

Warning



The motor must be earthed.

The motor must be connected to an external mains switch with a minimum contact gap of 3 mm in all poles.

If MS motors with a built-in temperature transmitter (Tempcon) are not installed together with an MP 204 motor protection unit, they must be connected to a $0.47 \mu\text{F}$ capacitor approved for phase-phase operation (IEC 384-14) to meet the EC EMC directive (2004/108/EC). The capacitor must be connected to the two phases to which the temperature transmitter is connected. See fig. 6.

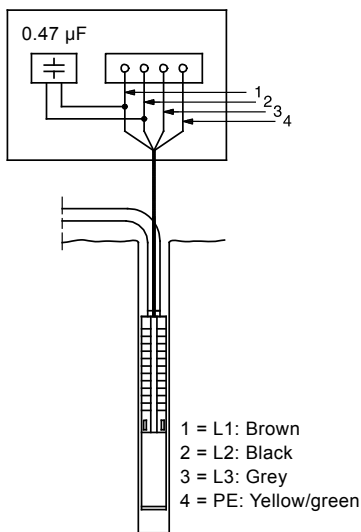


Fig. 6 Connection of capacitor

The motors are wound for direct-on-line starting or star-delta starting, and the starting current is between four and six times the rated current of the motor.

The run-up time of the motor is only about 0.1 second. Direct-on-line starting is therefore normally approved by the power supply company.

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5.1.1 Frequency converter operation

Three-phase MS motors can be connected to a frequency converter.

MMS motors with PE/PA can be connected to a frequency converter.

Caution

If an MS motor with temperature transmitter is connected to a frequency converter, a fuse incorporated in the transmitter will melt and the transmitter will be inactive. The transmitter cannot be reactivated. This means that the motor will operate like a motor without a temperature transmitter.

If a temperature transmitter is required, a Pt100 sensor for fitting to the submersible motor can be ordered from Grundfos.

Caution

During frequency converter operation, it is not advisable to run the motor at a frequency higher than the rated frequency (50 or 60 Hz). In connection with pump operation, it is important never to reduce the frequency (and consequently the speed) to such a level that the necessary flow of cooling liquid past the motor is no longer ensured.

To avoid damage to the pump part, make sure that the motor stops when the pump flow falls below 0.1 x rated flow.

Depending on the type, the frequency converter may cause increased acoustic noise from the motor. Furthermore, it may expose the motor to detrimental voltage peaks.

This can be avoided by installing a correctly dimensioned sinus filter between the frequency converter and the motor.

Grundfos recommends installing a sinus filter when a frequency converter is used.

Voltage peaks for Grundfos submersible motors should be limited in accordance with the table below.

Motor type	Max. U _{peak} voltage	Max. dU/dt
MS 402	650 V phase-phase	2000 V/μs
MS 4000	850 V phase-phase	2000 V/μs
MS 6000	850 V phase-phase	2000 V/μs
MMS6	850 V phase-ground	500 V/μs
MMS 8000	850 V phase-ground	500 V/μs
MMS 10000	850 V phase-ground	500 V/μs
MMS 12000	850 V phase-ground	500 V/μs

Note

To enable monitoring of the motor temperature when running at frequency converter operation, Grundfos recommends installing a Pt100 sensor together with a PR 5714 relay.

Permissible frequency ranges: 30-50 Hz and 30-60 Hz.

Ramp times: Maximum 3 seconds for start and stop.

5.2 Motor protection

5.2.1 Single-phase motors

Single-phase MS 402 submersible motors incorporate a thermal switch and require no additional motor protection. As a exception, the 1.1 kW (1.5 hp) MS 402 requires external current protection.



Warning

When the motor has been thermally switched off, the motor terminals are still live. When the motor has cooled sufficiently, it will restart automatically.

Single-phase MS 4000 submersible motors must be protected. A protective device can either be incorporated in a control box or be separate.

5.2.2 Three-phase motors

MS motors are available with or without a built-in temperature transmitter.

Motors with a built-in and operational temperature transmitter must be protected by:

- a motor-protective circuit breaker with thermal relay or
- an MP 204 motor protection unit and contactor(s).

Motors with or without a non-operational temperature transmitter must be protected by:

- a motor-protective circuit breaker with thermal relay or
- an MP 204 motor protection unit and contactor(s).

MMS motors have no built-in temperature transmitter. A Pt100 sensor is available as an accessory.

Motors with a Pt100 sensor must be protected by:

- a motor-protective circuit breaker with thermal relay or
- an MP 204 motor protection unit and contactor(s).

Motors without a Pt100 sensor must be protected by:

- a motor-protective circuit breaker with thermal relay with max. trip class 10 according to IEC 60947-4-1 or
- an MP 204 motor protection unit and contactor(s).

5.2.3 Required settings of the motor-protective circuit breaker

For motors with an MP 204 motor protection unit, Grundfos recommends using a special trip curve with P-characteristics at a setting of U_n times 5 for 1 second.

For cold motors, the tripping time for the motor-protective circuit breaker must be less than 10 seconds at five times the rated maximum current of the motor.

For all Grundfos submersible MMS motors, the maximum start and stop ramp time is 3 sec. (minimum 30 Hz).

Caution If this requirement is not met, the motor warranty will be invalidated.

In order to ensure optimum protection of the submersible motor, set the motor-protective circuit breaker in accordance with the following guidelines:

1. Set the overload to the rated maximum current of the motor.
2. Start the motor and let it run for half an hour at normal performance.
3. Slowly grade down the scale indicator until the motor trip point is reached.
4. Increase the overload setting by 5 %.

The highest permissible setting is the rated maximum current of the motor.

For motors wound for star-delta starting, set the motor-protective circuit breaker as above, but the maximum setting must be rated maximum current $\times 0.58$.

The highest permissible startup time for star-delta starting or autotransformer starting is 2 seconds.

5.3 Lightning protection

The installation can be fitted with a special overvoltage protection device to protect the motor from voltage surges in the power supply lines if lightning strikes somewhere in the area. See fig. 7.

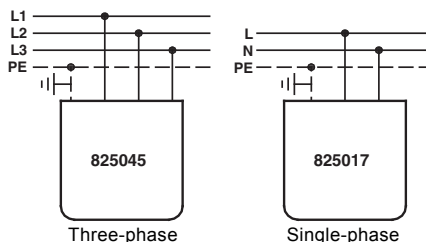


Fig. 7 Connecting an overvoltage protection device

The overvoltage protection device will not, however, protect the motor against a direct stroke of lightning.

Connect the overvoltage protection device to the installation as close as possible to the motor and always in accordance with local regulations. Ask Grundfos for lightning protection devices.

MS 402 submersible motors, however, require no further lightning protection as they are highly insulated.

Ask for a special cable termination kit with a built-in overvoltage protection device for Grundfos 4" submersible motors (product no. 799911/799912).

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5.4 Cable sizing

Caution

Submersible motor cables are dimensioned for submersion in the liquid, and will not necessarily have sufficient cross-section to be in air.

Make sure that the submersible drop cable can withstand permanent submersion in the actual liquid and at the actual temperature.

The cross-section (q) of the cable must meet the following requirements:

- The submersible drop cable must be sized to the rated maximum current (I_n) of the motor.
- The cross-section must be sufficient to make a voltage drop over the cable acceptable.

Grundfos supplies submersible drop cables for a wide range of installations. For correct cable sizing, Grundfos offers a cable sizing tool on the USB stick followed with the motor.

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Fig. 8 Cable sizing tool

The sizing tool provides an accurate calculation of the voltage drop at a given cross-section on the basis of the following parameters:

- cable length
- operating voltage
- full-load current
- power factor
- ambient temperature.

The voltage drop can be calculated both for direct-on-line and star-delta starting.

In order to minimise operating losses, the cable cross-section may be increased. This is only cost-efficient if the borehole provides the necessary space, and if the operating time of the pump is long. The cable sizing tool also provides a power loss calculator that shows the potential savings of an increased cross-section.

As an alternative to the cable sizing tool, select the cross-section on the basis of the current values of the given cables.

The cross-section of the submersible drop cable must be large enough to meet the voltage quality requirements specified in section 5.1 General.

Determine the voltage drop for the cross-section of the submersible drop cable by means of the diagrams on pages 20 and 21.

Use the following formula:

I = Rated maximum current of the motor.

For star-delta starting, I = rated maximum current of the motor $\times 0.58$.

L_x = Length of cable converted to a voltage drop of 1 % of the nominal voltage.

$$L_x = \frac{\text{length of drop cable}}{\text{permissible voltage drop in \%}}$$

q = Cross-section of submersible drop cable.

Draw a straight line between the actual I -value and the L_x -value. Where the line intersects the q -axis, select the cross-section that lies right above the intersection.

The diagrams are made on the basis of the formulas:

Single-phase submersible motor

$$L = \frac{U \times \Delta U}{I \times 2 \times 100 \times \left(\cos \varphi \times \frac{\rho}{q} + \sin \varphi \times X_l \right)}$$

Three-phase submersible motor

$$L = \frac{U \times \Delta U}{I \times 1.73 \times 100 \times \left(\cos \varphi \times \frac{\rho}{q} + \sin \varphi \times X_l \right)}$$

L = Length of submersible drop cable [m]

U = Rated voltage [V]

ΔU = Voltage drop [%]

I = Rated maximum current of the motor [A]

$\cos \varphi$ = 0.9

ρ = Specific resistance: 0.02 [$\Omega \text{mm}^2/\text{m}$]

q = Cross-section of submersible drop cable [mm^2]

$\sin \varphi$ = 0.436

X_l = Inductive resistance: 0.078×10^{-3} [Ω/m].

5.5 Control of single-phase MS 402

Warning



Single-phase MS 402 submersible motors < 1.1 kW incorporate motor protection which cuts out the motor in case of excessive winding temperatures while the motor is still supplied with voltage. Allow for this when the motor forms part of a control system.

5.6 Connection of single-phase motors

5.6.1 2-wire motors

MS 402 2-wire motors incorporate motor protection and a starter device and can therefore be connected directly to the mains. See fig. 9.

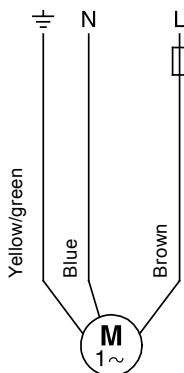


Fig. 9 2-wire motors

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5.6.2 PSC motors

PSC motors are connected to the mains via a run capacitor which must be sized for continuous operation.

Select the correct capacitor size from the table below:

Motor [kW]	Capacitor
0.25	12.5 μ F / 400 V / 50 Hz
0.37	16 μ F / 400 V / 50 Hz
0.55	20 μ F / 400 V / 50 Hz
0.75	30 μ F / 400 V / 50 Hz
1.10	40 μ F / 400 V / 50 Hz
1.50	50 μ F / 400 V / 50 Hz
2.20	75 μ F / 400 V / 50 Hz

MS 402 PSC motors < 1.1 kW incorporate motor protection and must be connected to the mains as shown in fig. 10.

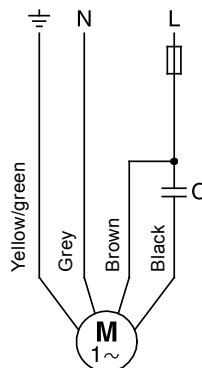


Fig. 10 PSC motors

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5.6.3 3-wire motors

MS 402 3-wire motors incorporate motor protection and must be connected to the mains via a Grundfos SA-SPM 5, 7 or 8 control box without motor protection.

MS 4000 3-wire motors must be connected to the mains via a Grundfos SA-SPM 5, 7 or 8 control box incorporating motor protection.

When a conventional motor-protective circuit breaker is used, the electrical connection must be carried out as described below.

5.6.4 Checking of direction of rotation

When the motor has been connected to the power supply, determine the correct direction of rotation as follows:

- 1. Add a few drops of water to the shaft seal before starting.
- 2. Start the motor and check the direction of rotation by watching the motor shaft. For Grundfos SP pumps, the direction of rotation must be counter-clockwise.
- 3. Compare the result from item 1 with the demand of the pump.
- 4. Interchange two of the phase connections if the direction of rotation is wrong. In the case of motors wound for star-delta starting, exchange U1 by V1 and U2 by V2.

5.6.5 Motors wound for direct-on-line starting

The connection of Grundfos submersible motors wound for direct-on-line starting appears from the table below and fig. 11.

Mains	Cable/connection
	Grundfos 4" and 6" motors
PE	PE (yellow/green)
L1	U (brown)
L2	V (black)
L3	W (grey)

Check the direction of rotation as described in section 5.6.4 *Checking of direction of rotation*.

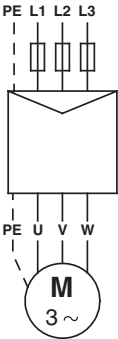


Fig. 11 Motors wound for direct-on-line starting

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5.6.6 Motors wound for star-delta starting

The connection of Grundfos submersible motors wound for star-delta starting appears from the table below and fig. 12.

Connection	Grundfos 6" motors
PE	Yellow/green
U1	Brown
V1	Black
W1	Grey
W2	Brown
U2	Black
V2	Grey

Check the direction of rotation as described in section 5.6.4 *Checking of direction of rotation*.

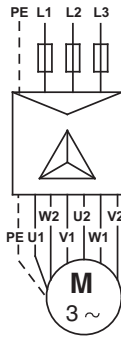


Fig. 12 Motors wound for star-delta starting

If star-delta starting is not required, but direct-on-line starting is, the submersible motors must be connected as shown in fig. 13.

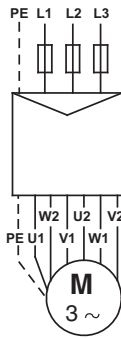


Fig. 13 Motors wound for direct-on-line starting

5.6.7 Connection in the case of unidentified cable marking/connection

If it is unknown where the individual leads are to be connected to the mains in order to ensure the correct direction of rotation, proceed as follows:

Motors wound for direct-on-line starting

Connect the motor to the mains as is expected to be right.

Then check the direction of rotation as described in section 5.6.4 *Checking of direction of rotation*.

Motors wound for star-delta starting

Determine the windings of the motor by means of an ohmmeter, and name the lead sets for the individual windings accordingly: U1-U2, V1-V2 and W1-W2. See fig. 14.

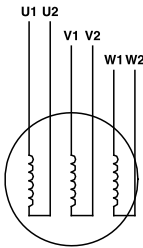


Fig. 14 Unidentified cable marking/connection - motors wound for star-delta starting

If star-delta starting is required, connect the leads as shown in fig. 12.

If direct-on-line starting is required, connect the leads as shown in fig. 13.

Then check the direction of rotation as described in section 5.6.4 *Checking of direction of rotation*.

5.6.8 Soft starter

Grundfos only recommends the use of soft starters which control the voltage on all three phases and which are provided with a bypass contact.

Ramp times: Maximum 3 seconds.

For further details, please contact your soft starter supplier or Grundfos.

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5.6.9 Frequency converter

Three-phase MS submersible motors can be connected to a frequency converter.

Note

To enable monitoring of the motor temperature, Grundfos recommends installing a Pt100 sensor together with a PR 5714 relay.

Permissible frequency ranges: 30-50 Hz and 30-60 Hz.

Ramp times: Maximum 3 seconds for start and stop.

Depending on the type, the frequency converter may cause increased acoustic noise from the motor.

Furthermore, it may expose the motor to detrimental voltage peaks. This can be compensated by installing an LC filter or even better a sinus filter between the frequency converter and the motor.

For further details, please contact your frequency converter supplier or Grundfos.

6. Motor installation


Warning

Before starting work on the product, switch off the power supply. Make sure that the power supply cannot be accidentally switched on.

7. Fitting the pump to the motor

1. Use pipe clamps when handling the motor.


Warning

When the motor is to be assembled with the pump at the borehole, make sure to use suitable pipe clamps.

2. Place the motor in vertical position at the borehole. See fig. 15.

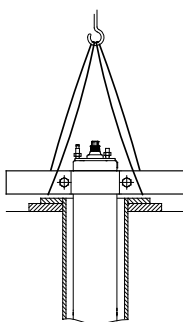


Fig. 15 Motor in vertical position

3. Lift the pump part by means of pipe clamps fitted to the riser pipe. See fig. 16.

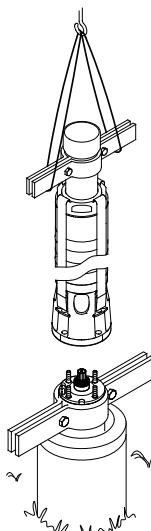


Fig. 16 Lifting the pump into position

4. Place the pump part on top of the motor.
5. Fit and cross-tighten the nuts to the torques stated below.

Caution

Make sure that the coupling between the pump and motor engages properly.

Pump/motor bolt diameter	Torque [Nm]
5/16 UNF	18
1/2 UNF	50
M8	18
M12	70
M16	150
M20	280

TM00 5259 2402

TM02 5263 2502

7.1 Fitting of submersible drop cable and motor cable

Before fitting the motor cable to the motor, make sure that the cable socket is clean and dry.

To ease fitting of the cable, lubricate the rubber parts of the cable plug with non-conducting silicone paste.

Tighten the screws holding the cable to the torques stated:

MS 402: 2.0 Nm

MS 4000: 3.0 Nm

MS 6000: 4.5 Nm

MMS6: 20 Nm

MMS 8000: 18 Nm

MMS 10000: 18 Nm

MMS 12000: 15 Nm.

Connect the motor cable to the drop cable by use of original Grundfos cable termination kits, such as shrink tube type KM or cable termination kit type M0 to M4.

If necessary, shorten the motor cable to ensure that it is always covered with pump medium prior to making the cable jointing as described above.

7.2 Maximum installation pressure

MS 402: 150 mWC

MS 4000: 600 mWC

MS 6000: 600 mWC

MMS: 600 mWC.

7.3 Lowering the pump

Grundfos recommends checking the borehole by means of an inside calliper before lowering the pump to ensure unobstructed passage.

Lower the pump assembly carefully into the borehole, taking care not to damage the motor cable and the submersible drop cable.

Caution

Do not lower or lift by means of the motor cable.

7.4 Frequency of starts and stops

Motor type		Number of starts
MS 402		- Minimum 1 per year is recommended. - Maximum 100 per hour. - Maximum 300 per day.
MS 4000		- Minimum 1 per year is recommended. - Maximum 100 per hour. - Maximum 300 per day.
MS 6000		- Minimum 1 per year is recommended. - Maximum 30 per hour. - Maximum 300 per day.
MMS6	PVC windings	- Minimum 1 per year is recommended. - Maximum 3 per hour. - Maximum 40 per day.
	PE/PA windings	- Minimum 1 per year is recommended. - Maximum 10 per hour. - Maximum 70 per day.
MMS 8000	PVC windings	- Minimum 1 per year is recommended. - Maximum 3 per hour. - Maximum 30 per day.
	PE/PA windings	- Minimum 1 per year is recommended. - Maximum 8 per hour. - Maximum 60 per day.
MMS 10000	PVC windings	- Minimum 1 per year is recommended. - Maximum 2 per hour. - Maximum 20 per day.
	PE/PA windings	- Minimum 1 per year is recommended. - Maximum 6 per hour. - Maximum 50 per day.
MMS 12000	PVC windings	- Minimum 1 per year is recommended. - Maximum 2 per hour. - Maximum 15 per day.
	PE/PA windings	- Minimum 1 per year is recommended. - Maximum 5 per hour. - Maximum 40 per day.

8. Maintenance and service

The motors are maintenance-free.
All motors are easy to service.
Service kits and service tools are available from Grundfos.
The motors can also be serviced at a Grundfos service centre.



Warning
If a motor has been used in a liquid which is injurious to health or toxic, the motor will be classified as contaminated. Clean the motor properly before starting service.
Be aware that the motor liquid may also be contaminated.

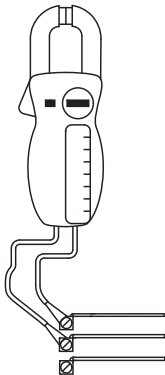
If you want Grundfos to service the motor, you must contact Grundfos with details about the possible contamination, etc. before you dispatch the motor. Otherwise, Grundfos may refuse to accept the motor for service.
Any costs of returning the motor must be paid by the customer.

9. Fault finding

Fault	Cause	Remedy
1. The motor does not run.	a) The fuses are blown.	Replace the blown fuses. If the new ones blow too, check the electrical installation and the submersible drop cable.
	b) The ELCB or the voltage-operated ELCB has tripped.	Cut in the circuit breaker.
	c) No power supply.	Contact the power supply company.
	d) The motor-protective circuit breaker has tripped.	Reset the motor-protective circuit breaker (automatically or possibly manually). If it trips again, check the voltage. If the voltage is OK, see items e) - h).
	e) Motor-protective circuit breaker/contactator is defective.	Replace the motor-protective circuit breaker/contactator.
	f) Starter device is defective.	Repair/replace the starter device.
	g) The control circuit has been interrupted or is defective.	Check the electrical installation.
	h) The pump/submersible drop cable is defective.	Repair/replace the pump/cable.

10. Checking of motor and cable

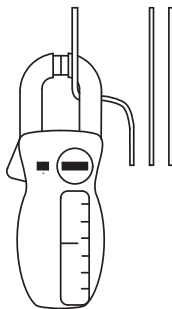
1. Supply voltage



Measure the voltage between the phases by means of a voltmeter. On single-phase motors, measure between phase and neutral or between two phases, depending on the type of supply. Connect the voltmeter to the terminals in the motor-protective circuit breaker.

When the motor is loaded, the voltage should be within the range specified in section [5.1 General](#). The motor may burn if there are larger variations in voltage. Large variations in voltage indicate poor power supply, and the motor must be stopped until the defect has been remedied.

2. Current consumption



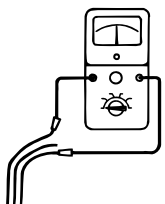
Measure the amps of each phase while the pump is operating at a constant discharge head (if possible, at the capacity where the motor is most heavily loaded). For maximum operating current, see nameplate.

On three-phase motors, the difference between the current in the phase with the highest consumption and the current in the phase with the lowest consumption must not exceed 5 %. If so, or if the current exceeds the rated current, the following faults are possible:

- The contacts of the motor-protective circuit breaker have burnt.
 - Replace the contacts or the control box for single-phase operation.
- Poor connection in leads, possibly in the cable joint.
 - See item 3.
- Too high or too low mains voltage.
 - See item 1.
- The motor windings are short-circuited or partly disjointed.
 - See item 3.
- Damaged pump is causing the motor to be overloaded.
 - Pull out the pump assembly for overhaul.
- The resistance value of the motor windings deviates too much (three-phase operation).
 - Move the phases in phase order to a more uniform load. If this does not help, see item 3.

Items 3 and 4: Measurement is not necessary when the supply voltage and the current consumption are normal.

3. Winding resistance



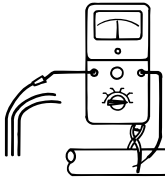
Disconnect the submersible drop cable from the motor-protective circuit breaker. Measure the winding resistance between the leads of the drop cable.

Three-phase motors: The deviation between the highest and lowest value must not exceed 10 %. If the deviation is higher, pull out the pump assembly. Measure motor, motor cable and drop cable separately, and repair/replace defective parts.

Note: On single-phase, 3-wire motors, the operating winding will assume the lowest resistance value.

4. Insulation resistance

a) Insulation resistance, MS

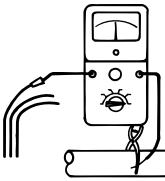


TM00 1374 5092

Disconnect the submersible drop cable from the motor-protective circuit breaker. Measure the insulation resistance from each phase to earth (frame). Make sure that the earth connection is made carefully.

If the insulation resistance is less than 0.5 MΩ, pull out the pump assembly for motor, cable or cable termination repair. Local regulations may specify other values for the insulation resistance.

b) Insulation resistance, MMS



TM00 1374 5092

Motors outside a well: Clean the motor cable end. Installed motors: Disconnect the submersible drop cable from the motor-protective circuit breaker and clean the cable end (contact points). Measure the insulation resistance from each phase to earth (frame) using an insulation tester (500 VDC, 2 min.). Make sure that the earth connection is made carefully.

Check the value on the instrument. If the insulation resistance is lower than the values below, pull out the pump assembly for checking and repair.

The values apply to an ambient temperature of 20 °C (68 °F).

With cable:

- new motor: 4 MΩ.
- used motor: 2 MΩ.

Without drop cable:

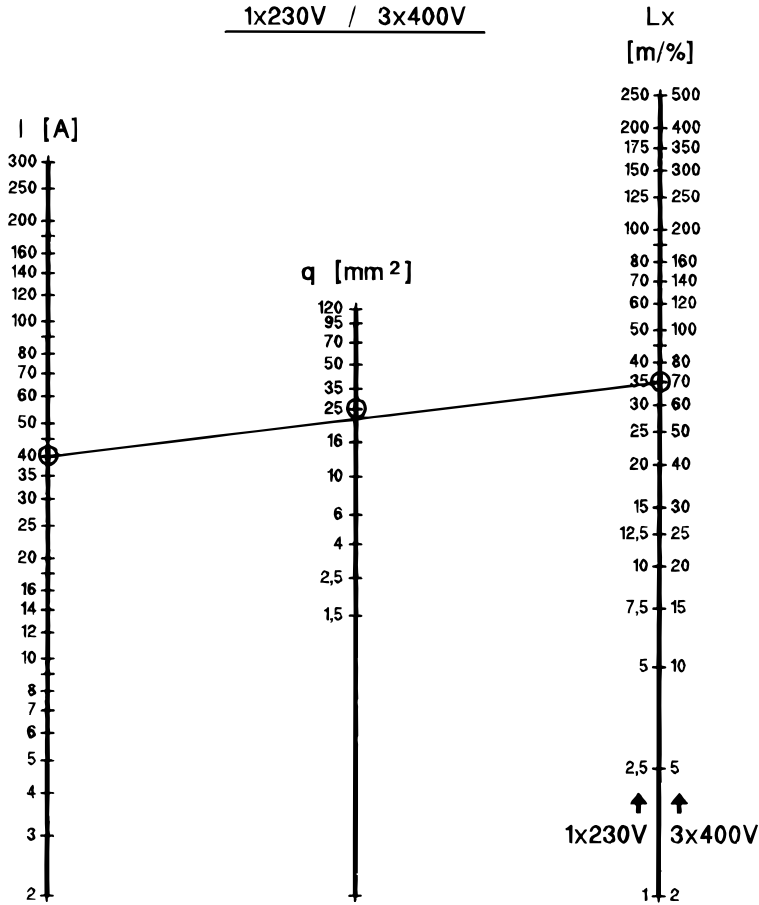
- new motor: 200 MΩ.
- used motor: 20 MΩ.

11. Disposal

This product or parts of it must be disposed of in an environmentally sound way:

1. Use the public or private waste collection service.
2. If this is not possible, contact the nearest Grundfos company or service workshop.

Subject to alterations.



TM00 1346 5092

Example:

U = 3 x 400 V
I = 40 A
L = 140 m
ΔU = 2 %

$$Lx = \frac{L}{\Delta U} = \frac{140}{2\%} = 70 \text{ m} = q \Rightarrow 25 \text{ mm}^2$$

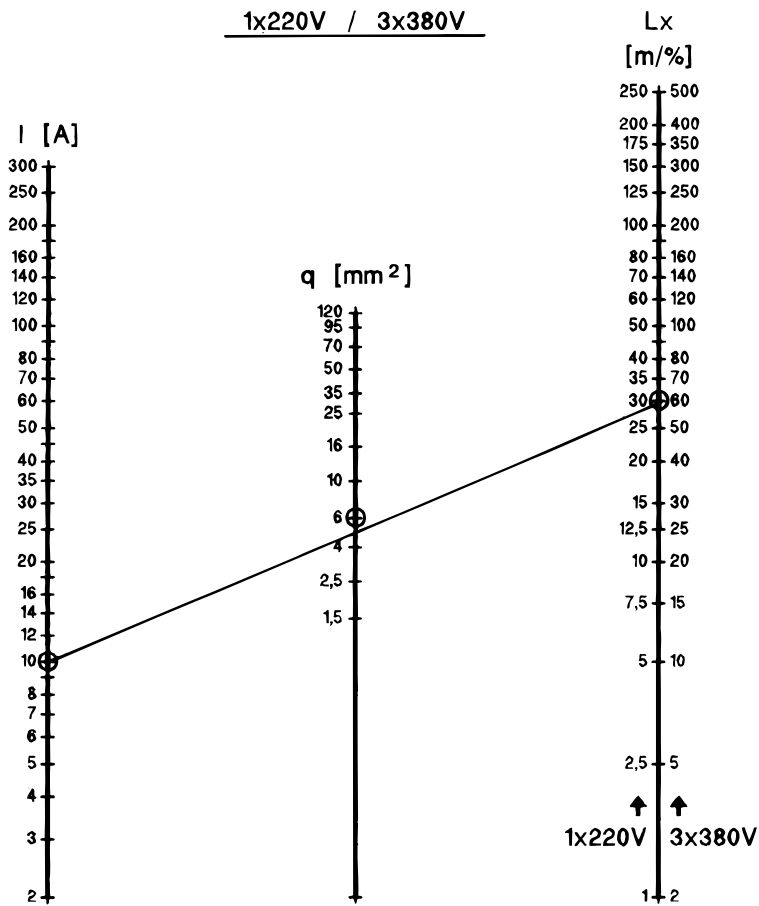
U = 3 x 400 V

I = 40 A

ΔU = 2 %

L = 140 m

1x220V / 3x380V



Example:

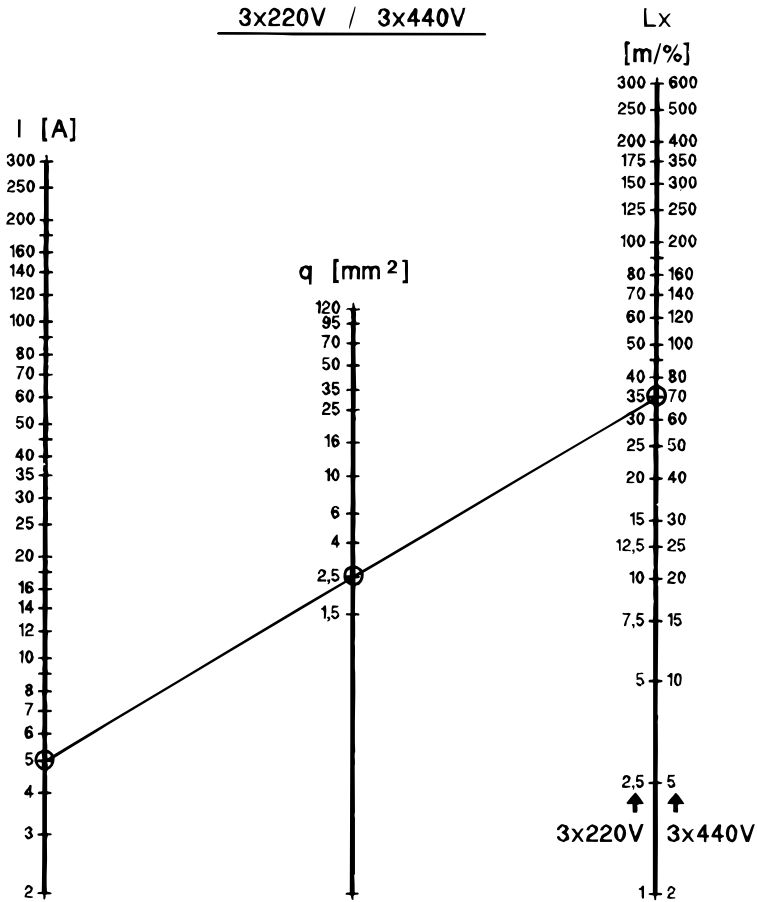
$U = 3 \times 380 \text{ V}$
 $I = 10 \text{ A}$
 $L = 120 \text{ m}$
 $\Delta U = 2 \%$

$Lx = \frac{L}{\Delta U} = \frac{120}{2\%} = 60 \text{ m} = q \Rightarrow 6 \text{ mm}^2$

$U = 3 \times 380 \text{ V}$
 $I = 10 \text{ A}$
 $\Delta U = 2 \%$
 $L = 120 \text{ m}$

TM00 1345 5092

3x220V / 3x440V

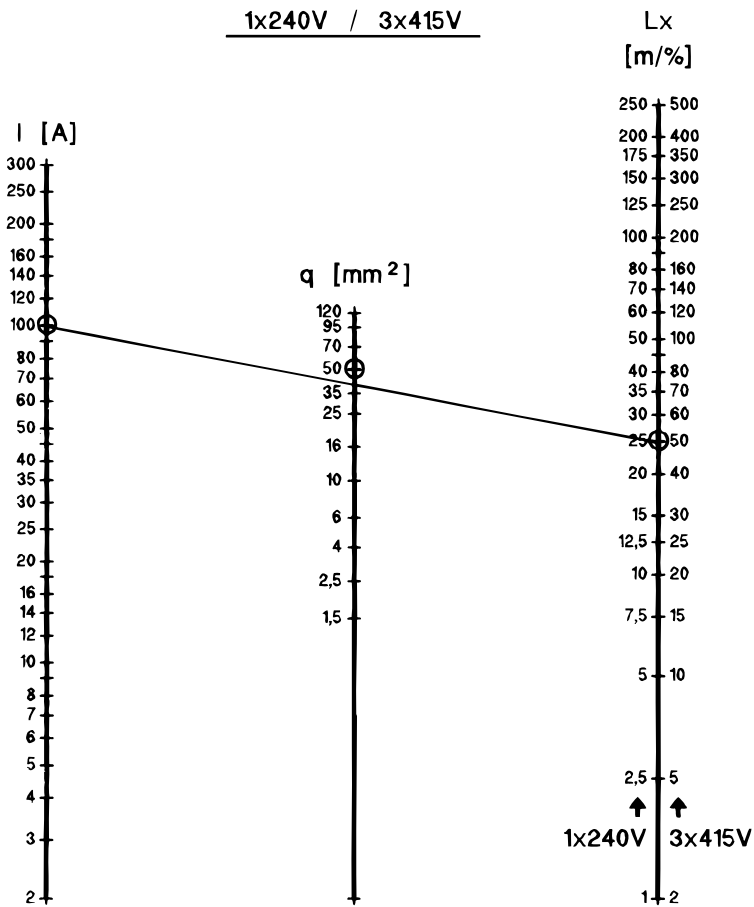


Example:

$U = 3 \times 220 \text{ V}$
 $I = 5 \text{ A}$
 $L = 105 \text{ m}$
 $\Delta U = 3 \%$

$$Lx = \frac{L}{\Delta U} = \frac{105}{3\%} = 35 \text{ m} = q \Rightarrow 2,5 \text{ mm}^2$$

The diagram shows a cable run from a terminal block to a switch. The cable is labeled with $U = 3 \times 220 \text{ V}$, $I = 5 \text{ A}$, $\Delta U = 3 \%$, and $L = 105 \text{ m}$.



TM00 1347 5092

Example:

$U = 3 \times 415 \text{ V}$
 $I = 100 \text{ A}$
 $L = 150 \text{ m}$
 $\Delta U = 3 \%$

$Lx = \frac{L}{\Delta U} = \frac{150}{3\%} = 50 \text{ m} = q \Rightarrow 50 \text{ mm}^2$

$U = 3 \times 415 \text{ V}$
 $I = 100 \text{ A}$
 $\Delta U = 3 \%$

$L = 150 \text{ m}$

Declaration of conformity

GB: EU declaration of conformity

We, Grundfos, declare under our sole responsibility that the products MS, MMS, to which the declaration below relates, are in conformity with the Council Directives listed below on the approximation of the laws of the EU member states.

CZ: Prohlášení o shodě EU

My firma Grundfos prohlašujeme na svou plnou odpovědnost, že výrobky MS, MMS, na které se toto prohlášení vztahuje, jsou v souladu s ním uvedenými ustanoveními směrnice Rady pro sblížení právních předpisů členských států Evropského společenství.

DK: EU-overensstemmelseserklæring

Vi, Grundfos, erklærer under ansvar at produkterne MS, MMS som erklæringen nedenfor omhandler, er i overensstemmelse med Rådets direktiver der er nævnt nedenfor, om indbyrdes tilnærmelse til EU-medlemsstaternes lovgivning.

ES: Declaración de conformidad de la UE

Grundfos declara, bajo su exclusiva responsabilidad, que los productos MS, MMS a los que hace referencia la siguiente declaración cumplen lo establecido por las siguientes Directivas del Consejo sobre la aproximación de las legislaciones de los Estados miembros de la UE.

FR: Déclaration de conformité UE

Nous, Grundfos, déclarons sous notre seule responsabilité, que les produits MS, MMS, auxquels se réfère cette déclaration, sont conformes aux Directives du Conseil concernant le rapprochement des législations des États membres UE relatives aux normes énoncées ci-dessous.

HR: EU deklaracija sukladnosti

My, Grundfos, izjavljujemo s punom odgovornošću da su proizvodi MS, MMS, na koja se izjava odnosi u nastavku, u skladu s direktivama Vijeća dolje navedene o usklađivanju zakona država članica EU-a.

IT: Dichiarazione di conformità UE

Grundfos dichiara sotto la sua esclusiva responsabilità che i prodotti MS, MMS, ai quale si riferisce questa dichiarazione, sono conformi alle seguenti direttive del Consiglio riguardanti il avvicinamento delle legislazioni degli Stati membri UE.

LV: ES atbilstības deklarācija

Sabiedrība Grundfos ar pilnu atbildību paziņo, ka produkti MS, MMS, uz kuru attiecas tālāk redzamā deklarācija, atbilst tālāk norādītajām Padomes direktīvām par EK/ES dalībvalstu normatīvo aktu tuvināšanu.

PL: Deklaracja zgodności UE

My, Grundfos, oświadczamy z pełną odpowiedzialnością, że nasze produkty MS, MMS, których deklaracja niniejsza dotyczy, są zgodne z następującymi dyrektywami Rady w sprawie zbliżenia przepisów prawnych państw członkowskich.

RO: Declarația de conformitate UE

Noi Grundfos declarăm pe propria răspundere că produsele MS, MMS, la care se referă această declarație, sunt în conformitate cu Directivele de Consiliu specificate mai jos privind armonizarea legilor statelor membre UE.

RU: Декларация о соответствии нормам ЕС

Мы, компания Grundfos, со всей ответственностью заявляем, что изделия MS, MMS, к которым относится нижеприведенная декларация, соответствуют нижеприведенным Директивам Совета Евросоюза о тождественности законов стран-членов ЕС.

SI: Izjava o skladnosti EU

V Grundfosu s polno odgovornostjo izjavljamo, da je izdelek MS, MMS, na katerega se spodnja izjava nanaša, v skladu s spodnjimi direktivami Sveta o približevanju zakonodaje za izenačevanje pravnih predpisov držav članic EU.

TR: AB uygunluk bildirgesi

Grundfos olarak, aşağıdaki bildirim konusunu olan MS, MMS ürünlerini, AB Üye ülkelerinin direktiflerini yaklaşıtlarılmasıyla ilgili durumun aşağıdaki Konsey Direktifleriyle uyumlu olduğunu ve bununla ilgili olarak tüm sorumluluğun bize ait olduğunu beyan ederiz.

BG: Декларация за съответствие на ЕО

Ние, фирма Grundfos, заявяваме с пълна отговорност, че продуктите MS, MMS, за които се отнася настоящата декларация, отговарят на следните директиви на Съвета за уеднавяване на правните разпоредби на държавите-членки на ЕО.

DE: EU-Konformitätserklärung

Wir, Grundfos, erklären in alleiniger Verantwortung, dass die Produkte MS, MMS, auf die sich diese Erklärung beziehen, mit den folgenden Richtlinien des Rates zur Angleichung der Rechtsvorschriften der EU-Mitgliedsstaaten übereinstimmen.

EE: EU vastavusdeklaratsioon

Meie, Grundfos, kinnitame ja kanname ainuiskulist vastutust selle eest, et toode MS, MMS, mille kohta all olev deklaratsioon käib, on kooskõlas Nõukogu Direktiividega, mis on nimetatud all pool vastavalt vastuvõetud õigusaktidele ühtlustamise kohta EU liikmesriikides.

FI: EU-vaatimustenmukaisuusvakuutus

Grundfos vakuuttaa omalla vastuullaan, että tuotteen MS, MMS, joita tämä vakuutus koskee, ovat EU:n jäsenvaltioiden laisäädännön lähentämiseen tähtäviien Euroopan neuvoston direktiivien vaatimusten mukaisia seuraavasti.

GR: Δήλωση συμμόρφωσης ΕΕ

Εμείς, η Grundfos, δηλώνουμε με αποκλειστικά δική μας ευθύνη ότι τα προϊόντα MS, MMS, στα οποία αναφέρεται η παρακάτω δήλωση, συμμορφώνονται με τις παρακάτω Οδηγίες του Συμβουλίου περί προσέγγισης των νομοθεσιών των κρατών μελών της ΕΕ.

HU: EU megfelelőségi nyilatkozat

Mi, a Grundfos vállalat, teljes felelősséggel kijelentjük, hogy a(z) MS, MMS termékek, amelyek az alábbi nyilatkozat vonatkozik, megfelelnek az Európai Unió tagállamainak jogi irányelveit összehangoló tanács alábbi előírásainak.

LT: ES atitikties deklaracija

Mes, Grundfos, su visa atsakomybe pareiškiame, kad produktai MS, MMS, kuriems skirta ši deklaracija, atitinka žemiau nurodytas Tarybos Direktyvas dėl ES šalių narių įstatymų suderinimo.

NL: EU-conformiteitsverklaring

Wij, Grundfos, verklaren geheel onder enige verantwoordelijkheid dat de producten MS, MMS, waarop de onderstaande verklaring betrekking heeft, in overeenstemming zijn met de onderstaande Richtlijnen van de Raad inzake de onderlinge aanpassing van de wetgeving van de EU-lidstaten.

PT: Declaração de conformidade UE

A Grundfos declara sob sua única responsabilidade que os produtos MS, MMS, aos quais diz respeito a declaração abaixo, estão em conformidade com as Directivas do Conselho sobre a aproximação das legislações dos Estados Membros da UE.

RS: Deklaracija o usklađenosti EU

Mi, kompanija Grundfos, izjavljujemo pod punom vlastitom odgovornošću da je proizvod MS, MMS, na koji se odnosi deklaracija ispod, u skladu sa dole prikazanim direktivama Saveta za usklađivanje zakona država članica EU.

SE: EU-försäkran om överensstämmelse

Vi, kompani Grundfos, försäkrar under ansvar att produkterna MS, MMS, som omfattas av nedanstående försäkran, är i överensstämmelse med de rättsdirektiv om inbördes närmande till EU-medlemsstaternas lagstiftning som listas nedan.

SK: ES vyhlásenie o zhode

My, spoločnosť Grundfos, vyhlasujeme na svoju plnú zodpovednosť, že produkty MS, MMS na ktoré sa vyhlásenie uvedené nižšie vzťahuje, sú v súlade s ustanoveniami nižšie uvedených smerníc Rady pre zblíženie právnych predpisov členských štátov EÚ.

UA: Декларація відповідності директивам ЕУ

Ми, компанія Grundfos, під нашу односторонню відповідальність заявляємо, що вироби MS, MMSMS, до яких відноситься нижченаведена декларація, відповідають директивам ЕУ, переліченим нижче, щодо тотожності законів країн-членів ЄС.

These Directives and standards apply from 20th April 2016 and onwards:

- Low Voltage Directive (2014/35/EU),
Standard used: EN 60034-1: 2010.
- EMC Directive (2014/30/EU),
Standards used: EN 60034-1: 2010. (Applies only to motors with
Tempcon sensors)

This EC declaration of conformity is only valid when published as part of the Grundfos installation and operating instructions (publication number: 96163721 0416).

Bjerringbro, 21st March 2016



Zoltán Lajtos
Engineering Manager
Grundfos Holding A/S
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8850 Bjerringbro, Denmark

Person authorised to compile technical file and
empowered to sign the EC declaration of conformity.



Электродвигатели серии MS, MMS сертифицированы на соответствие требованиям Технического регламента Таможенного союза ТР ТС 004/2011 «О безопасности низковольтного оборудования»; ТР ТС 020/2011 «Электромагнитная совместимость технических средств».

Сертификат соответствия:

№ ТС RU C-DK.АИ30.В.00417, срок действия до 02.12.2018г.

Выдан: Органом по сертификации продукции «ИВАНОВО-СЕРТИФИКАТ» ООО «Ивановский Фонд Сертификации».

Адрес: 153032, Российская Федерация, г. Иваново, ул. Станкостроителей, д.1.

Сертификат соответствия и Руководство по эксплуатации в электронном виде доступно на сайте компании www.grundfos.ru.

Истра, 1 ноября 2015 г.

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